Number One Air Conditioning Maker

Carrier

Division of Carrier Corporation

Carrier Parkway • Syracuse N Y 13221

Installation, Start-Up and Service Instructions

48GH,GL

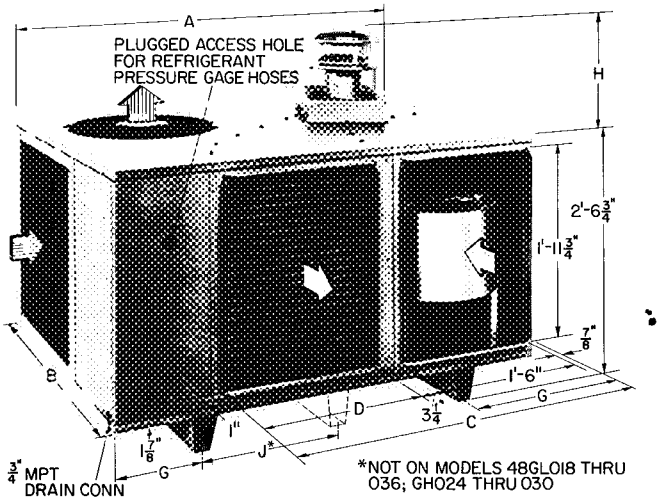
018 thru 060

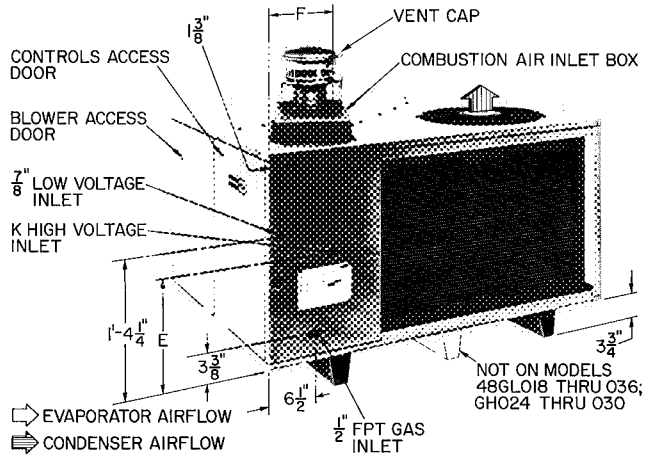
Combination Heating/Cooling Units

NOTE TO INSTALLER: THESE INSTRUCTIONS SHOULD BE LEFT WITH THE EQUIPMENT OWNER.

INDEX

	Page
SAFETY CONSIDERATIONS	2
INTRODUCTION	2
GENERAL	2
INSTALLATION	2-8
Step 1 — Rig and Place Unit	2
• ROOFTOP INSTALLATION	
• GROUND LEVEL INSTALLATION	
• CLEARANCES	
• CONDENSATE DISPOSAL	
• VENTING	
Step 2—Make Gas Piping Connections	5
Step 3 — Make Duct Connections	5
Step 4 — Make Wiring Connections	6-8
• HIGH-VOLTAGE CONNECTIONS	
• SPECIAL PROCEDURES FOR 208-V OPERATION	
• LOW-VOLTAGE CONNECTIONS	
• HEAT ANTICIPATOR SETTING	
START-UP	8-16
OPERATING SEQUENCE	16,17
SERVICE	17-20
TROUBLESHOOTING CHARTS	21,22





48GH,GL REQUIRED CLEARANCES (ft-in)

Above flue vent	3-0
Duct side of unit	0-6
Side opposite ducts	2-6
Blower access panel side	2-6
Side opposite blower access panel	2-6
Bottom of unit	0

NOTE Provision must be made for fresh ambient air to reach the outdoor coil without recirculation of the air from the outdoor fan discharge

Fig. 1 — Dimensions

© Carrier Corporation 1982

SAFETY CONSIDERATIONS

Installation, start-up and servicing of this equipment can be hazardous due to system pressures, electrical components and equipment location (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start-up and service this equipment.

Consult the Owner's Manual for routine maintenance. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature, tags, stickers and labels attached to the equipment and any other safety precautions that apply.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging and setting bulky equipment.

WARNING: Do not disconnect electric power to this appliance without first turning off the gas supply. Be sure power to equipment is shut off before performing maintenance or service.

INTRODUCTION

Models 48GH/GL Packaged Gas/Electric Units are fully self-contained, combination gas-heating/electric-cooling units designed for outdoor installation either on a rooftop or ground-level slab. See Fig. 1.

These units are equipped with an energy-saving automatic intermittent electric spark ignition system that does not have a continuously-burning pilot. Also included is the Time Guard II circuit for added compressor protection. All units are manufactured with natural gas controls.

Models 48GH/GL are AGA design-certified with 2 input ratings. See Table 1. All units are manufactured for operation at the minimum rating. For operation at the maximum ratings, optional burner orifices must be field installed. See Table 3.

These units are factory charged with R-22 refrigerant. To install: connect gas supply, air ducts, high- and low-voltage wiring, condensate drain, and install a field-supplied air filter in the return-air ductwork.

All units can be connected into existing duct systems *that are properly sized and designed to handle an airflow of 350 to 450 cfm per each 12,000 Btuh of rated cooling capacity.* See Tables 1 and 4 for cooling and heating airflow requirements.

NOTE: When installing any accessory item, see Installation Instructions packaged with the accessory.

IMPORTANT — READ BEFORE INSTALLING

1. This installation must conform with all applicable local and national codes.
2. Power supply (volts, hertz and phase) must correspond to that specified on unit rating plate.
3. Electrical supply provided by utility must be sufficient to handle load imposed by this unit.
4. Refer to the 48GH/GL dimensional drawing for locations of gas inlet, electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place.
5. Locate the unit where the vent cap will be a minimum of 4 ft from openable windows or doors.
6. This installation must conform with local building codes and with the National Fuel Gas code ANSI Z223.1-1980.

GENERAL

Models 48GH/GL Packaged Gas/Electric Units have been designed and tested in accordance with ANSI Z21.47-1978, ARI Standard 210-79 and ARI Standard 270-75. The appliance design is certified by the American Gas Association (AGA) for use with natural or LP (propane) gases with appropriate components and orifices.

INSTALLATION

Step 1 — Rig and Place Unit

CAUTION: When rigging unit to be lifted, use spreader bars to protect top and sides. Models 48GH/GL must be rigged for lifting as shown in Fig. 2. Use extreme caution to prevent damage when moving unit.

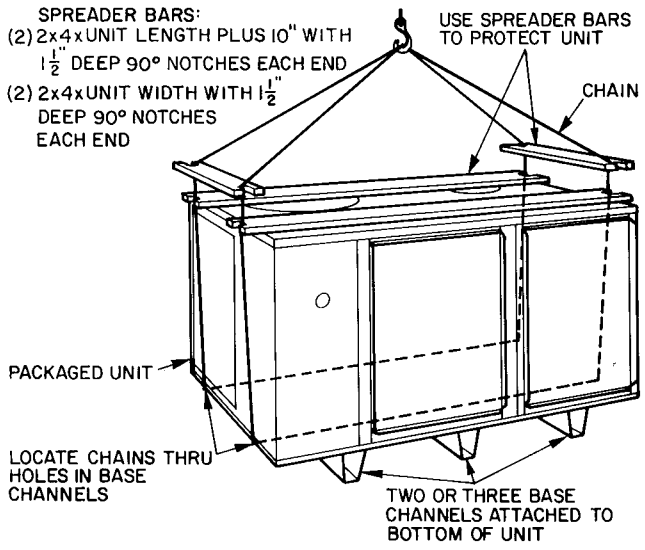

SPREADER BARS:
(2) 2x4 x UNIT LENGTH PLUS 10" WITH 1½" DEEP 90° NOTCHES EACH END
(2) 2x4 x UNIT WIDTH WITH 1½" DEEP 90° NOTCHES EACH END
USE SPREADER BARS TO PROTECT UNIT
CHAIN
PACKAGED UNIT
LOCATE CHAINS THRU HOLES IN BASE CHANNELS
TWO OR THREE BASE CHANNELS ATTACHED TO BOTTOM OF UNIT

Fig. 2 — 48GH/GL Suggested Rigging

Unit must remain in an upright position during all rigging and moving operations. Unit must be level for proper condensate drainage; therefore, ground-level pad or field-supplied mounting curb must be level before setting unit in place.

ROOFTOP INSTALLATION

CAUTION: When installing unit on a rooftop, be sure roof will support the additional weight. Refer to Product Data Digest to obtain total weight and corner weight information.

When installing a Model 48GH/GL end-discharge unit with a field-supplied downflow plenum, a field-supplied roof-mounting curb must be installed on and flashed into roof before unit installation.

When installing a Model 48GH/GL end-discharge unit *without* a downflow plenum, place unit on a level base that provides proper support. On flat roofs be sure that unit is located at least 4 in. above highest expected water level on roof to prevent flooding. Consult local codes for additional installation requirements.

GROUND-LEVEL INSTALLATION — Place unit on a solid, level concrete pad that is a minimum of 4 in. thick and that extends approximately 2 in. beyond casing on all 4 sides of unit. Do not secure unit to pad *except* when required by local codes.

CLEARANCES — The required minimum operating and service clearances are shown in Fig. 1.

CAUTION: Do not restrict condenser airflow. An air restriction at either outdoor-air inlet (the entire surface of the outdoor coil) or fan discharge can be detrimental to compressor life.

Condenser fan discharges thru top of unit. Ensure that fan discharge does not recirculate to condenser coil. Do not locate unit in either a corner or under a complete overhead obstruction. Minimum clearance under a partial overhang (such as a normal house roof overhang) is 3 ft above vent cap.

Do not locate unit where water, falling ice or snow from an overhang or roof will damage or flood the unit. Do not locate unit where grass, shrubs, or other plants will interfere with airflow either into or out of unit.

CONDENSATE DISPOSAL

NOTE. Ensure that condensate-water disposal methods comply with local codes, restrictions and practices.

Models 48GH/GL dispose of condensate water thru a 3/4-in. MPT drain fitting. See Fig. 1 for location.

Install a 3-in. trap at drain fitting to ensure proper drainage. See Fig. 3. Make sure trap outlet is at least 2 in. lower than unit drain pan connection to prevent pan from overflowing. Prime trap with water.

If the installation requires draining condensate water away from the unit, connect a drain tube using a minimum of 7/8-in. OD copper tubing,

→ **Table 1 — Installation**

MODEL 48	GL018	GL024	GH024	GL030	GH030	GL036			GH036	
SERIES	320	320	320	320/330	320/330	320/330	520/530	620/630	320/330	520/5
DIMENSIONS (ft-in.)										
A	4-5-5/8				4-5-5/8					
B	2-6-3/8				3-4-3/8					
C	3-2-1/8				3-5-1/8					
D	1-4				1-7					
E	1-4				1-1-1/4					
F	0-7-1/4				0-8-7/8					
G	0-11				0-10					
H	1-0-5/8				1-5-5/8					
J	—				—					
K	0-1-3/32				0-1-3/8					
FIELD-SUPPLIED FILTER SIZE (sq. in.)*										
Standard Disposable Type	289	396	396/433†	522	522	576	576	576	583/722†	583/72
Cleanable- or High-Capacity Type	188	257	257/281†	339	339	374	374	374	379/469†	379/46
OPERATING WT (lb)	320	325	375	375	375	380	380	380	475	475
SHIPPING WT (lb)	330	335	385	385	385	390	390	390	485	485
HEATING INPUT‡ (Btuh)										
Min	40,000	40,000	60,000	40,000	60,000	60,000	60,000	60,000	100,000	100,00
Max	50,000	50,000	75,000	50,000	75,000	75,000	75,000	75,000	125,000	125,00
COOLING AIRFLOW (Cfm)	600	825	825	1088	1088	1200	1200	1200	1215	1215
EXTERNAL STATIC PRESSURE (in. wg)	0 10	0 10	0 10	0 15	0 15	0 15	0 15	0 15	0 15	0 15

*Recommended, field-supplied air filter areas shown are based on either cooling airflow at a velocity of 300 ft per minute or heating airflow at a temperature of 60 F, depending on whichever value is larger Air filter pressure drop should not exceed 0 08 in wg for unit to produce rated cooling performance

†When Models 48GH024 or GH036 are installed for operation at minimum rated heating input, recommended minimum air filter area is the smaller sq in figure shown for each type of filter Larger figures shown are mini-

3/4-in. galvanized pipe, or 7/8-in. plastic pipe. *Do not undersize the tube.* Pitch drain tube downward at a slope of at least 1 in. in every 10 ft of horizontal run. Be sure to check drain tube for leaks.

Condensate water can be drained directly onto roof in rooftop installations (where permitted) or onto a gravel apron in ground-level installations. When using a gravel apron, make sure it slopes away from unit.

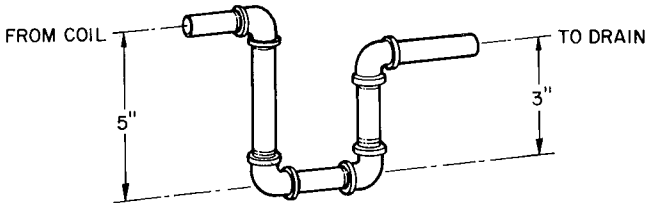


Fig. 3 — Condensate Trap

VENTING — The vent cap and combustion-air duct assemblies are shipped in either the blower or control compartment. Remove access doors to locate assemblies. See Fig. 1 for door locations. Vent stack extension is shipped either in air hole in unit top or fastened to back of the control box or in blower compartment.

CAUTION: Venting system is designed to ensure proper venting. Vent cap assembly must be installed as indicated in this section of Installation Instructions.

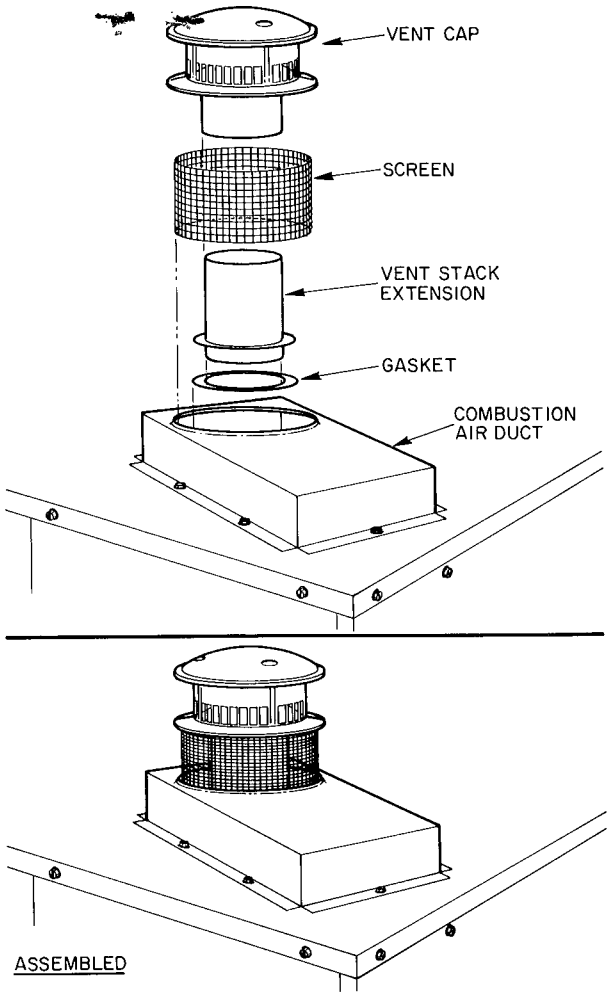


Fig. 4 — Vent Cap Assembly

allation Data

H036	GL042		GH042		GL048			GH048		GL060	GH060
520/530	320	520	320	520	320	520	620	320	520	320/330	320/330
	5- 5-5/8 3- 8-5/8 3-10-1/8 2- 0 1- 1-1/4 0- 8-7/8 0-10 1- 6-1/4 1-10-5/8 0- 1-3/8				6- 0-3/8 3- 8-5/8 4- 6-1/8 2- 8 1- 1-1/4 0- 8-7/8 0-10-1/2 1- 3-1/4 2-0-11/16 0- 1-3/8						6- 0-3/8 3- 8-5/8 4- 6-1/8 2- 8 1- 1-1/4 0- 8-7/8 0-10-1/2 1- 6-1/4 2-0-11/16 0- 1-3/8
583/722†	672	672	672	672	768	768	768	768	768	951	951
379/469†	437	437	437	437	499	499	499	499	499	618	618
475	420	420	440	440	535	535	535	555	555	575	605
485	430	430	450	450	545	545	545	565	565	585	615
100,000	60,000	60,000	80,000	80,000	80,000	80,000	80,000	100,000	100,000	100,000	120,000
125,000	75,000	75,000	100,000	100,000	100,000	100,000	100,000	125,000	125,000	125,000	150,000
1215	1400	1400	1400	1400	1600	1600	1600	1600	1600	1981	1981
0 15	0 15	0 15	0 15	0 15	0 20	0 20	0 20	0 20	0 20	0 20	0 20

mum recommended filter areas when these units have been field converted for operation at maximum rated heating input

‡All units have a minimum and maximum AGA-certified rated heating input and are manufactured with burner orifices for heating operation at minimum rating *Units may not be derated below this minimum rating*

NOTE: Screw holes in vent stack extension and unit top are positioned to ensure proper orientation when installed.

Refer to Fig. 4 and install vent cap as follows:

1. Place combustion-air duct over combustion-air opening in unit top, and line up screw holes in duct with holes in top. Secure duct to top using screws with rubber washers (provided).
2. Place gasket and vent stack extension thru hole in combustion-air duct, orient screw holes in base of vent stack extension with holes in unit top, and secure gasket and vent stack extension to unit top using screws provided.
3. Form flat wire screen (provided) into circular shape around protruding lip of combustion-air duct, and bend wire ends thru holes of screen mesh to secure screen in place. Make sure that no sharp edges are left exposed.
4. Place vent cap sleeve inside vent stack extension. Orient spring clip of vent cap with slot in extension. Be sure that clip snaps into slot to secure clip onto extension.

Step 2 — Make Gas Piping Connections — The gas supply pipe enters unit thru access hole provided. See Fig. 1 for location. The gas connection to unit is made to the 1/2-in. FPT gas inlet on gas valve.

Install a separate gas supply line that runs directly from meter to heating section. *Do not use cast-iron or galvanized pipe.* Check local utility for recommendations concerning existing lines. Choose a supply pipe that is large enough to keep pressure loss as low as practical. *Never use pipe smaller than the 1/2-in. FPT gas inlet on gas valve.*

When installing gas supply line, observe local codes pertaining to gas pipe installations. Refer to National Fuel Gas Code ANSI Z223.1-1980 in absence of local building codes. Adhere to pertinent recommendations.

1. Avoid low spots in long runs of pipe. Grade all pipe 1/4-in. in every 15 ft to prevent traps. Grade all horizontal runs downward to risers. Use risers to connect to heating section and to meter.
2. Support all piping with appropriate hangers, etc. Use a minimum of one hanger in every 6 feet. For pipe sizes larger than 1/2 in., follow recommendations of national codes.
3. Apply joint compounds (pipe dope) sparingly and only to male threads of joint when making pipe connections. Use only pipe dope that is resistant to action of liquefied petroleum gases as specified by local and/or national codes. *Never use Teflon tape.*
4. Install a sediment trap in riser leading to the heating section. This drip leg functions as a trap for dirt and condensate. Install trap where condensate cannot freeze. Install this sediment trap by connecting a piping tee to riser leading to heating section so that straight-thru section of tee is vertical. See Fig. 5. Then, connect capped nipple into lower end of tee. Extend capped nipple below level of gas controls.

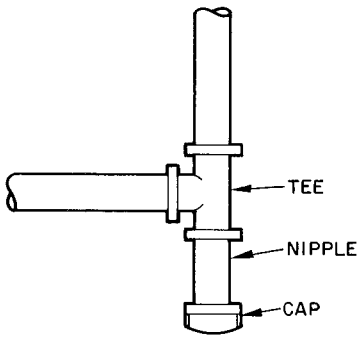


Fig. 5 — Sediment Trap

5. Install an accessible, external, manual shutoff valve in gas supply pipe within 6 ft of heating section. Install a 1/8-in. NPT plugged tapping that is accessible for test-gage connection immediately upstream of gas supply connection to heating section.
6. Install ground-joint union close to heating section between gas valve and external manual shutoff valve.

CAUTION: Unstable operation may occur, particularly under high-wind conditions, when gas valve and manifold assembly are forced out of position while connecting improperly routed rigid gas piping to gas valve. Use a backup wrench when making connection to avoid strain on, or distortion of, gas control piping.

7. Use flexible gas pipe to make connection between rigid gas piping and gas valve where permitted by local codes. Flexible pipe ensures proper alignment between manifold orifices and burner.

WARNING: Never use a match or other open flame when checking for gas leaks.

8. Check for gas leaks at all field-installed and factory-installed gas lines after all piping connections have been completed. Use soap-and-water solution (or method specified by local codes and/or regulations).

Step 3 — Make Duct Connections — Model 48GH/GL has duct flanges on the supply- and return-air openings on side of unit. See Fig. 1 for connection sizes and locations.

WARNING: The design and installation of duct system must be in accordance with standards of National Fire Protection Association for installation of nonresidence-type air conditioning and ventilating systems, NFPA No. 90; or residence-type, NFPA No. 90B; and/or local codes and ordinances.

Table 2 — Electrical Data

MODEL 48	SERIES	V-PH	OPER VOLTAGE RANGE		TOTAL AMPS	MAX BRANCH CIRCUIT FUSE SIZE (Amps)*	MCA	MIN WIRE SIZE (AWG)†	MAX WIRE LENGTH (ft)†
			Min	Max					
GL018	320	208-230-1	197	253	11 4	20	13.8	14	67
GL024	320	208-230-1	197	253	16 0	30	19 4	12	76
GH024	320	208-230-1	197	253	17 3	30	20 7	10	112
GL030	320/330	208-230-1	197	253	19 3	35	23 4	10	100
GH030	320/330	208-230-1	197	253	19.1	35	23 2	10	101
GL036	320/330	208-230-1	197	253	25 0	45	30.0	10	77
	520/530	208/230-3	187	253	18 6	35	21 9	10	121
	620/630	460-3	414	506	9 1	15	10 8	14	218
GH036	320/330	208-230-1	197	253	24.8	45	29 8	10	78
	520/530	208/230-3	187	253	19 5	35	22.8	10	116
GL042	320	208-230-1	197	253	26.4	50	31 8	8	117
	520	208/230-3	187	253	21 9	40	25.8	10	103
GH042	320	208-230-1	197	253	26 2	50	31 6	8	117
	520	208/230-3	187	253	21.3	40	25.2	10	106
GL048	320	230-1	207	253	30 3	60	36 3	8	107
	520	208/230-3	187	253	26 6	45	30 8	8	135
	620	460-3	414	506	11.7	20	13 5	14	169
GH048	320	230-1	207	253	29 5	60	35.5	8	110
	520	208/230-3	187	253	24 6	45	28 8	10	92
GL060	320/330	230-1	207	253	43.4	60	52 3	6	116
GH060	320/330	230-1	207	253	43 7	60	52 6	6	116

AWG — American Wire Gage
MCA — Minimum Circuit Ampacity

*Maximum Dual Element Size.
†Use only copper wire for field connections to unit. Wire size is based on 60 C or 75 C copper conductor at 86 F (30 C) ambient temperature and ampacity shown in table If other than 60 C or 75 C copper conductor is used, if ambient temperature is above 86 F, or if voltage drop of the wire exceeds 2% of total rated voltage of the unit, determine wire size from ampacity shown and National Electrical Code (NEC). Wire lengths shown are measured one way along wire path between unit and service panel for minimum voltage drop.

Adhere to the following criteria when selecting, sizing, and installing duct system:

1. Select and size ductwork, supply-air registers and return-air grilles according to Carrier System Design Manual, Part 2. System airflow must be within range of temperature rise and external static pressure shown on unit AGA rating plate.

CAUTION: When duct-system fastening holes are being drilled into side of Model 48GH/GL instead of the unit duct flanges, use extreme care to avoid puncturing coil or coil tubes.

2. Use a flexible transition between rigid ductwork and unit to prevent transmission of vibration. The transition may be screwed or bolted to duct flanges. Use suitable gaskets to ensure a weather and airtight seal.
3. Install an external, field-supplied air filter(s) in return-air ductwork where it is easily accessible for service. Recommended filter sizes are shown in Table 1.
4. Size all ductwork for maximum required airflow (either heating or cooling) for unit being installed. Avoid abrupt duct size increases or decreases.
5. Adequately insulate and weatherproof all ductwork located outdoors. Insulate ducts passing thru an unconditioned space, and use a vapor barrier in accordance with latest issue of SMACNA and NESCA minimum installation standards for heating and air conditioning systems. Secure all ducts to building structure.
6. Flash, weatherproof and vibration-isolate all openings in building structure in accordance with local codes and good building practices.

Step 4 — Make Wiring Connections

WARNING: Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with National Electrical Code and local electrical codes. *Do not use gas piping as an electrical ground.* A failure to follow this warning could result in the installer being liable for the personal injury of others.

CAUTION: A failure to follow these precautions could result in damage to unit being installed:

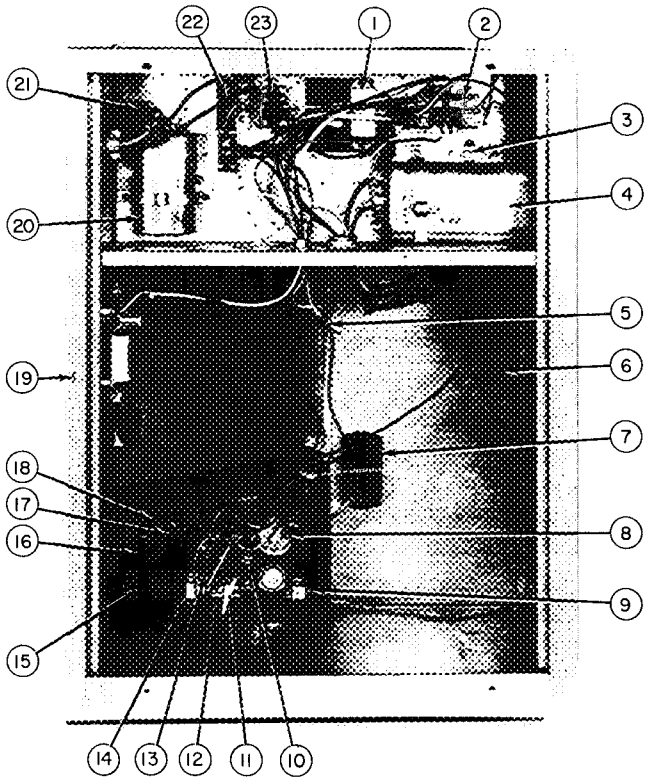
1. Make all electrical connections in accordance with National Electrical Code and local electrical codes governing such wiring.
2. Use only *copper* conductor for connections between field-supplied electrical disconnect switch and the unit. *Do not use aluminum or copper-clad aluminum wire.*
3. Ensure that high-voltage power to unit is within operating voltage range indicated on unit rating plate. On 3-phase units, ensure that phases are balanced within 2%. Consult the local power company for correction of improper voltage and/or phase imbalance.
4. Insulate low-voltage wires for highest voltage contained within conduit when low-voltage control wires are run in same conduit as high-voltage wires.
5. Do not damage internal components when drilling thru any panel to mount electrical hardware, conduit, etc.
6. Make sure that service conductors used between the electrical service panel and field-supplied electrical disconnect switch do not have a current capacity less than the copper wire specified, and do not create a total voltage drop in excess of 2% of rated voltage of the unit.

NOTE: When using aluminum conductor from electrical service to disconnect switch (where local codes permit use of aluminum wire), make the connections in accordance with National Electrical Code. Prepare all aluminum wire immediately before installation by "brush-scratching" the wire, then coating the wire with a corrosion inhibitor (such as Pentrox A). Be sure that entire connection is completely covered to prevent an electrochemical reaction that will cause the connection to fail very quickly. Do not reduce effective size of wire by cutting off strands to fit wire into a connector. Always use properly sized connectors.

HIGH-VOLTAGE CONNECTIONS — Unit must have a separate electrical service with a field-supplied, waterproof, fused disconnect switch per NEC mounted at, or within sight from, the unit. Refer to unit rating plate for maximum fuse size and minimum circuit amps (ampacity) for wire sizing. Table 2 shows recommended wire sizes and lengths based on rating plate data.

The field-supplied disconnect switch box may be mounted on unit over the high-voltage inlet hole in control corner panel. See Fig. 1.

WARNING: Label part no. A-74191B, which is shipped loose in bag of parts, *must be affixed* to the disconnect switch box. This label states: "DO NOT DISCONNECT THE ELECTRICAL POWER TO THIS APPLIANCE WITHOUT FIRST TURNING OFF THE GAS SUPPLY."



1 — Control Transformer
2 — Compressor Contactor
3 — Ground Lug
4 — Dual Run Capacitor (for compressor and condenser fan motor)
5 — Low-Voltage Pigtail Leads
6 — Compressor/Control Compartment Divider Panel
7 — Igniter Module
8 — Manual On/Off Knob
9 — Gas Valve Inlet
10 — Pipe Plug — LP (Propane) unit pressure switch mounts here
11 — Pilot Tube
12 — Model 646A-X Gas Valve
13 — Pressure Tap Pipe Plug
14 — Gas Valve Outlet
15 — Gas Manifold
16 — Gas Burner
17 — Burner Air Shutter
18 — Secondary-Air Shield
19 — Blower Housing
20 — Evaporator Motor Run Capacitor
21 — Blower/Control Compartment Divider Panel
22 — Heating Relay
23 — Cooling Relay

Fig. 6 — Model 48GL036 — Side View (Partial) with Access Doors Removed

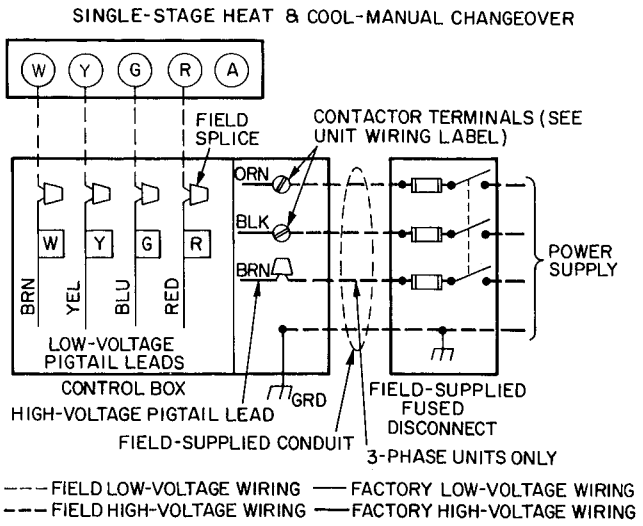
Proceed as follows to complete the high-voltage connections to unit:

1. Connect ground lead to chassis ground connection when using a separate ground wire.
2. Run high-voltage leads with field-supplied conduit into unit control box and connect to contactor. See unit wiring label, and Fig. 6 and 7.

NOTE: On 3-phase units, connect third high-voltage lead to brown high-voltage pigtail lead. See unit wiring label and Fig. 7.

SPECIAL PROCEDURES FOR 208-V OPERATION

WARNING: Make sure that power supply to unit is switched OFF before making any wiring changes.



NOTE:
For manual changeover applications, use thermostat part no HH01AD042 with subbase part no HH93AZ042; or thermostat part no. HH01AD040 with subbase part no HH93AZ040

For automatic changeover, use thermostat part no HH07AT074 with subbase part no HH93AZ096; or thermostat part no HH10AD041 with subbase part no HH93AZ041

Fig. 7 — High- and Low-Voltage Connections

When operating Models 48GL018 thru 042 single-phase units or Models 48GH036 thru 048 three-phase units at 208 volts, disconnect orange transformer-primary lead from contactor. See unit wiring label and Fig. 7. Remove tape and cover from terminal on the end of red transformer-primary lead. Save cover. Connect red lead to contactor terminal from which orange lead was disconnected.

Using cover removed from red lead, insulate loose terminal on orange lead. Wrap cover with electrical tape so that metal terminal cannot be seen.

NOTE: For some units, the factory-wired blower-motor speed connections may require changing for 208-volt operation to ensure adequate airflow at the rated external static pressure. See unit wiring label. Insulate all unused motor leads following same procedures described for transformer leads.

LOW-VOLTAGE CONNECTIONS — Use a suitable room thermostat as specified on unit wiring label.

Locate room thermostat on an inside wall in space to be conditioned where it will not be subjected to either a cooling or heating source, or direct exposure to sunlight. Mount thermostat 4 to 5 ft above floor.

Use No. 18 AWG color-coded, insulated (35 C minimum) wires to make low-voltage connections between thermostat and unit. If thermostat is located more than 100 ft from unit (as measured along the low-voltage wires), use No. 16 AWG color-coded, insulated (35 C minimum) wires.

A grommeted, low-voltage inlet hole is located in a panel adjacent to control access panel. See Fig. 1. Run low-voltage leads from thermostat, thru inlet hole, and to low-voltage flagged pigtail leads that run thru a hole in bottom of unit control box. See Fig. 6. Connect thermostat leads to the pigtail leads as shown in Fig. 7.

HEAT ANTICIPATOR SETTING — Room thermostat heat anticipator must be properly adjusted to ensure proper heating performance. Set heat anticipator to approximately 0.85 amps. Use an ammeter to determine exact required setting.

Failure to make a proper heat anticipator adjustment will result in improper operation, discomfort to occupants of conditioned space, and inefficient energy utilization; however, required setting may be changed slightly to provide a greater degree of comfort for a particular installation.

START-UP

Unit Preparation

WARNING/DANGER: Failure to observe the following warnings could result in serious personal injury:

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
3. Do not remove compressor terminal cover until all electrical sources have been disconnected.
4. Relieve all pressure from system before touching or disturbing anything inside terminal box if a refrigerant leak is suspected around compressor terminals.
5. Do not use a torch to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
   a. Shut off gas supply and *then* electrical power to unit.
   b. Relieve all pressure from system.
   c. Cut component connecting tubing with tubing cutter and remove component from unit.
   d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

PRE-START-UP PROCEDURES — Proceed as follows to inspect and prepare unit for initial start-up:

1. Remove all access panels.
2. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to or shipped with the unit, such as blower rotation labels, etc.

3. Make following inspections:
   a. Inspect for shipping and handling damages such as broken lines, loose parts, disconnected wires, etc.
   b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections using electronic leak detector, halide torch, or liquid-soap solution. If refrigerant leak is detected, see REFRIGERANT LEAKS in next part of this section.
   c. Inspect all field- and factory-wiring connections. Be sure that connections are completed and tight.
   d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.

WARNING: Do not purge gas supply into combustion chamber. Do not use a match or other open flame to check for gas leaks.

4. Verify the following conditions:
   a. Make sure that gas supply has been purged, and that all gas piping has been checked for leaks.
   b. Make sure that outdoor fan blade is correctly positioned in fan orifice. *Blades should clear fan motor by exactly 1/4 inch.*
   c. Make sure that air filter(s) is in place.
   d. Make sure that condensate drain pan is filled with water to ensure proper drainage.
   e. Make sure that all tools and miscellaneous loose parts have been removed.
5. Replace all access panels. Unit is now ready for initial start-up.

REFRIGERANT LEAKS — Proceed as follows to repair a refrigerant leak and to charge the unit:

WARNING: Never attempt to repair a soldered connection while the refrigerant system is under pressure. Severe bodily injury may result. Always wear protective goggles when servicing the refrigerant system.

1. Locate leak and ensure that refrigerant system pressure has been relieved.
2. Repair leak following accepted practices.

NOTE: Install a filter drier whenever system has been opened for repair.

3. Add a small charge of R-22 refrigerant vapor to system and leak-test unit.
4. Evacuate refrigerant system if additional leaks are not found.
5. Charge unit with R-22 refrigerant, using a volumetric-charging cylinder such as Dial-a-Charge or accurate scale. *Refer to unit rating plate for required charge.* Be sure to add extra refrigerant to compensate for internal volume of filter drier.

NOTE: See Cooling Section Start-Up and Adjustments — CHECKING AND ADJUSTING REFRIGERANT CHARGE.

Heating Section Start-Up and Adjustments

CAUTION: Complete required procedures given in Unit Preparation section before starting unit.

Do not jumper any safety devices when operating unit.

Ensure that burner orifices are properly aligned. Unstable operation may occur when burner orifices in manifold are misaligned. To ensure correct burner orifice alignment, check orifice angle with a machinist's protractor or other suitable device. The orifice angle must be from horizontal to 3 degrees down, as measured from unit base.

Follow instructions on heating section operation label (located in unit near the gas valve) to start heating section.

CHECKING HEATING CONTROL OPERATION — Start and check unit for proper heating control operation as follows:

Place room thermostat selector switch in HEAT position and fan switch in AUTO. position. Set heating temperature control of thermostat above room temperature. Observe that after built-in time delays, pilot automatically lights, burners light, and blower motor starts. Observe that burners and pilot go out, and that after a built-in delay blower motor stops when heating control setting of thermostat is satisfied.

GAS INPUT — Unit rating plate indicates 2 AGA-certified gas inputs. When shipped from factory, manifold has natural-gas burner orifices that deliver minimum rated gas input. Optional field-installed burner orifices are required to provide optional maximum rated gas input. See Table 3.

When unit is being installed for operation at the optional input, proceed as follows to install field-supplied burner orifices:

1. Remove burner shield and burners.
2. Remove factory-supplied burner orifices from manifold and replace with field-supplied orifices.
3. Replace burners and burner shield.
4. Mark appropriate changes on unit rating plate.

CAUTION: These units are designed to consume rated gas inputs using fixed orifices at specified manifold pressures as shown in Table 3. *Do not redrill orifices under any circumstances.*

Table 3 — Rated Gas Inputs (Btuh) for Various Burner Orifices at Indicated Manifold Pressures*

MODEL 48	NUMBER OF ORIFICES	MANIFOLD PRESSURE (in. wg)		NATURAL GAS		LP (Propane) GAS	
		Nat	LP (Propane)	Orifice Part No.	Heating Input (Btuh)†	Orifice Part No	Heating Input (Btuh)†
GL018,024,030	2	3 5	10 5	LH32DB-205‡ (Min)	40,000	LH32DB-201	40,000
				LH32DB-207 (Max)	50,000	LH32DB-060	50,000
GH024,030 GL036,042	3	3 5	10 5	LH32DB-205‡ (Min)	60,000	LH32DB-201	60,000
				LH32DB-207 (Max)	75,000	LH32DB-060	75,000
GH042; GL048	4	3 5	10 5	LH32DB-200‡ (Min)	80,000	LH32DB-201	80,000
				LH32DB-096 (Max)	100,000	LH32DB-060	100,000
GH036,048 GL060	5	3 5	10 5	LH32DB-200‡ (Min)	100,000	LH32DB-201	100,000
				LH32DB-096 (Max)	125,000	LH32DB-060	125,000
GH060	6	3 5	10 5	LH32DB-200‡ (Min)	120,000	LH32DB-201	120,000
				LH32DB-096 (Max)	150,000	LH32DB-060	150,000

*Data in this table is based on altitudes from sea level up to either 7000 ft above sea level at the minimum rated input, or 2000 ft above sea level at the maximum rated input For higher altitudes, follow the recommendations of national and local codes

†Gas inputs for natural gas are based on a heating value of 1050 Btu per cu ft with a specific gravity of 0 65 at the factory-set manifold pressure of 3 5 in wg Gas inputs for LP (propane) gas are based on a heating value of 2500 Btu per cu ft with a specific gravity of 1 5 at a manifold pressure of 10 5 in wg

‡These natural gas burner orifices are the factory-supplied orifices. All other natural gas orifices shown are optional field-supplied orifices

The minimum and maximum rated gas inputs shown in Table 3 are for altitudes from sea level up to either 7000 ft above sea level at minimum input, or 2000 ft above sea level at maximum input. These inputs are based on natural gas with a heating value of 1050 Btu per cubic foot at 0.65 specific gravity, or LP (propane) gas with a heating value of 2500 Btu per cubic foot at 1.5 specific gravity. For elevations above either 7000 ft at minimum input or 2000 ft at maximum input, reduce ratings 4% of *maximum* input for each 1000 ft above sea level. When gas supply being used has a different heating value or specific gravity, refer to Carrier training and application materials, national and local codes, or contact your Carrier dealer to determine required orifice size.

ADJUSTING GAS INPUT

CAUTION: When adjusting the gas input, do not change manifold pressure *more than 0.3 in. wg* above or below setting shown in Table 3. If larger adjustments are required, change burner orifices following recommendations of national and local codes.

Gas input to unit is adjusted by changing manifold pressure. Use REG ADJ screw on gas valve to change manifold pressure as follows:

To increase input: Turn screw clockwise.

To decrease input: Turn screw counterclockwise.

Gas input can be determined and adjusted by using one of the following 2 recommended methods:

1. Measuring gas flow at meter.
2. Measuring manifold pressure.

Measuring Gas Flow at Meter

NOTE: All other gas appliances that use the same meter must be turned off when the gas flow is measured at the meter.

Proceed as follows to measure gas flow at meter to determine gas input:

a. Determine number of seconds for gas meter test dial to make one revolution.
b. Divide number of seconds in *step a* into 3600 (number of seconds in an hour).
c. Multiply result of *step b* by number of cu ft shown for one revolution of test dial to obtain cu ft of gas flow per hour.
d. Multiply result from *step c* by Btuh heating value of gas to obtain total measured input in Btuh. Compare this value with input shown in Table 3.

NOTE: Consult local gas supplier if heating value of gas is not known.

Example: Assume that size of the test dial is 1 cu ft, one revolution takes 30 seconds, and heating value of gas is 1050 Btuh per cubic foot, then proceed as follows:

a. 30 seconds to complete one revolution.
b. 30 divided into 3600 equals 120.
c. 120 times 1 equals 120 cu ft of gas flow per hour.
d. 120 times 1050 equals 126,000 Btuh input.

If desired gas input is 125,000 Btuh, only a minor change in manifold pressure is required.

Measuring Manifold Pressure — When heating value of gas is significantly more or less than design value, or slight manifold pressure changes are necessary for other reasons, manifold pressure may be changed to adjust gas input. Use a water manometer to measure manifold pressure. If a spring manometer is used, make sure manometer is calibrated.

Proceed as follows to measure and change manifold pressure:

a. Turn off gas to unit.
b. Remove pipe plug on gas valve outlet identified as PRESS TAP, then connect manometer at this point.
c. Turn on gas to unit and start heating section.
d. Measure and change manifold pressure with all burners fired to obtain desired gas input.
e. Turn off gas to unit, remove manometer from gas valve, and replace pipe plug.

ADJUSTING BURNER AIR SHUTTERS — After burners have operated at full input for at least 10 minutes, adjust primary air to each burner to ensure optimum heating performance. Make these adjustments when unit is being installed and during routine maintenance inspections at beginning of each heating season. *Be sure that each burner is clean and free of deposits before adjusting primary air.*

The primary air to each burner is regulated by burner air shutter on each burner. See Fig. 8 for location of burner air shutter. With all burners operating, adjust primary air to each burner as follows:

1. Loosen locking screw that secures air shutter in place on burner, then partially close air shutter until a slight yellow tip appears on top of burner flames.
2. Open air shutter *very slowly* until yellow tip just disappears, then secure air shutter in place with locking screw.
3. Repeat steps 1 and 2 for each burner.

After air shutter adjustments have been completed, observe that flames on each burner are light blue and "soft" in appearance, and that flames are same height along the entire length of each burner. See Fig. 8.

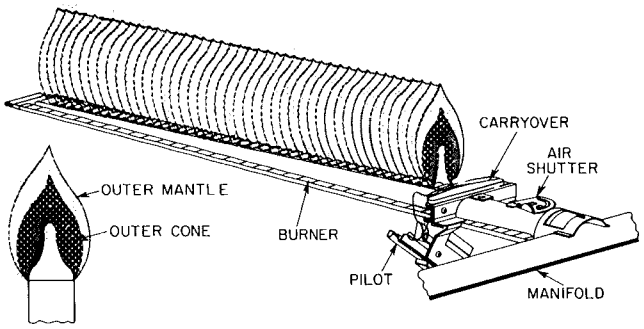


Fig. 8 — Burner Flames

BLOWER HEAT-RELAY OPERATION — Heating relay (see Fig. 6 and unit wiring diagram) is located in control box and adjusts to permit either longer or shorter OFF cycles. The ON cycle automatically adjusts as OFF cycle changes. Adjusting lever on relay is factory-set at center position to provide optimum performance for most installations. On unusual installations, or where line voltage is considerably above or below rated voltage, length of time blower remains on may require increasing or decreasing. To increase blower operation time, move adjusting lever toward right-hand position. In this position, control makes contact sooner and takes maximum time to break contact. To decrease blower operation time, move lever toward left-hand position.

AIRFLOW AND TEMPERATURE RISE — Temperature rise is temperature difference between air in return duct and air in discharge duct at unit. Heating section of each size of unit is designed and approved for heating operation within temperature rise range stamped on unit rating plate.

Table 4 shows the approved temperature rise range for each unit and air delivery (cfm) at various temperature rises for both AGA-certified gas input ratings. Heating operation airflow must produce a temperature rise that falls within approved range.

Table 4 — Air Delivery (Cfm) at Indicated Temperature Rise and Rated Heating Input

MODEL 48	HEATING INPUT (Btuh)	TEMPERATURE RISE (F)																
		35	37 5	40	42 5	45	47.5	50	52 5	55	57 5	60	62 5	65	67 5	70	72 5	75
GL018,024, 030	40,000*	794	741	694	654	617	585	556	529	505	483	463	444	427	412	397	383	370
	50,000	1032	963	903	850	802	760	722	688	657	628	602	578	556	535	516	498	481
GH024,030 GL036,042	60,000*	1190	1111	1042	980	926	877	833	794	758	725	694	667	641	617	595	575	556
	75,000	1548	1444	1354	1275	1204	1140	1083	1032	985	942	903	867	833	802	774	747	722
GH042 GL048	80,000*	1587	1481	1389	1307	1235	1170	1111	1058	1010	966	926	889	855	823	794	766	741
	100,000	2063	1926	1806	1699	1605	1520	1444	1376	1313	1256	1204	1156	1111	1070	1032	996	963
GH036,048 GL060	100,000*	1984	1852	1736	1634	1543	1462	1389	1323	1263	1208	1157	1111	1068	1029	992	958	926
	125,000	2579	2407	2257	2124	2006	1901	1806	1720	1641	1570	1505	1444	1389	1337	1290	1245	1204
GH060	120,000*	2381	2222	2083	1961	1852	1754	1667	1587	1515	1449	1389	1333	1282	1235	1190	1149	1111
	150,000	3095	2889	2708	2549	2407	2281	2167	2063	1970	1884	1806	1733	1667	1605	1548	1494	1444

*These inputs are the minimum rated inputs using factory-installed burner orifices Higher inputs shown for each size are the maximum rated inputs using field-installed, optional burner orifices that are indicated on unit rating plate

NOTE: Models 48GL018,024,036; 48GH024,030 have an approved temperature rise range of 35 to 75 F All other units have an approved temperature rise range of 45 to 75 F

Refer to Cooling Section Start-Up and Adjustments — INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS of these instructions to adjust heating airflow when required.

LIMIT AND PRESSURE SWITCHES — Furnace limit switch (see Fig. 9) closes gas valve if leaving-air temperature exceeds 175 F.

Normally closed limit switch completes control circuit thru pigtail lead W to gas valve. See Fig. 9. Should the leaving-air temperature rise to 175 F, switch opens and W control circuit breaks. Any interruption in W control circuit instantly closes gas valve and stops gas flow to burners and pilot. The indoor fan motor continues to run until time-delay sequence of time delay relay (heating) is completed.

When air temperature at limit switch drops to the low-temperature setting of limit switch, switch closes and completes W control circuit. Electric-spark ignition system cycles and unit returns to normal heating operation.

Pressure switch (Fig. 9) is required only when unit operates on LP (propane) gas.

Cooling Section Start-Up and Adjustments

CAUTION: Complete required procedures given in Unit Preparation section before starting unit.

Do not jumper any safety devices when operating unit.

Do not operate compressor when outdoor temperature is below 55 F.

To prevent rapid cycling of compressor, Time Guard II circuit is supplied as standard equipment.

CHECKING COOLING CONTROL OPERATION — Start and check unit for proper cooling control operation as follows:

1. Place room thermostat selector switch in OFF position. Observe that blower motor starts when fan switch is placed in ON position and shuts off when fan switch is placed in AUTO. position.
2. Place selector switch in COOL position and fan switch in AUTO. position. Set cooling control below room temperature. Observe that compressor, condenser fan, and evaporator blower motors start. Observe that cooling cycle shuts down when control setting is satisfied.
3. When using an automatic changeover room thermostat, place both selector and fan switches in AUTO. position. Observe that unit operates in heating mode when temperature control is set to call for heating (above room temperature) and operates in cooling mode when temperature control is set to call for cooling (below room temperature).

CHECKING AND ADJUSTING REFRIGERANT CHARGE — Refrigerant system is fully charged with R-22 refrigerant, tested, and factory sealed. For most applications, factory charge is the correct amount for best performance.

NOTE: Adjustment of refrigerant charge is not required unless unit is suspected of not having proper R-22 charge. For all applications, correct R-22 charge for best performance is charge that results in a suction gas superheat of 5 F at compressor inlet when unit is operating at ARI rating conditions of 95 F db outdoor and 80 F db/67 F wb indoor.

An operating pressure/temperature tag is fastened inside the compressor compartment. When evaluating the refrigerant charge by checking operating pressures and temperatures, use tag to approximate charge if ARI rating conditions cannot be obtained. See Table 5. This method of evaluating ensures that an optimum refrigerant charge is in system when system conditions and components are normal; however, adjusting refrigerant charge does not solve or fix system abnormalities.

Amount of refrigerant charge affects how efficiently and economically unit operates. An overcharged or undercharged unit leads to diminished cooling efficiency, high operating costs and the possibility of premature compressor failure.

CAUTION: When evaluating refrigerant charge, an indicated adjustment to specified factory charge must always be minimal. If a substantial adjustment is indicated, an abnormal condition exists somewhere in cooling system, such as insufficient airflow across either coil or both coils.

NOTE: For best results, evaluate refrigerant charge when outdoor temperature is 65 F or higher.

Proceed as follows to evaluate system performance and refrigerant charge:

1. Remove caps from low- and high-pressure service fittings.
2. Attach low- and high-side pressure gage hoses to low- and high-pressure service fittings, respectively. *Hoses must have valve core depressors. Gages must be calibrated for accuracy.*
3. Set room thermostat below room temperature to start cooling operation. Allow unit to operate until conditions stabilize and pressures level out.
4. Determine and record these conditions:
   a. Low- and high-side pressures.
   b. *Dry-bulb* temperature of inlet air at outdoor condenser coil.
   c. *Wet-bulb* temperature of inlet air at indoor evaporator coil.
   d. Suction gas temperature at compressor inlet if unit is operating at ARI standard rating conditions indicated on operation pressure/temperature tag.

Table 5 — Refrigerant (R-22) Charge Check Charts*

MODEL 48	EVAPORATOR AIR INLET WET BULB (F)	CONDENSER AIR INLET TEMP (F)							
		65	70	75	80	85	90	95	100
GL018	55	138	156	174	192	211	229	247	265
	60	143	161	178	196	213	231	249	266
	65	148	165	182	199	216	233	251	268
	70	153	169	186	202	219	236	252	269
	75	158	174	190	206	222	238	254	270
GL024	55	157	170	183	197	210	223	238	253
	60	158	172	185	198	212	225	240	255
	65	160	173	187	200	214	228	243	259
	70	161	175	189	202	217	232	247	262
	75	163	177	191	205	220	235	251	267
GH024	55	148	163	178	193	208	224	239	254
	60	150	165	181	195	211	226	241	256
	65	151	167	182	197	213	228	243	258
	70	153	169	184	199	215	230	245	261
	75	155	171	186	202	217	232	247	263
GL030, GH030	55	163	178	193	208	220	235	247	262
	60	165	180	195	210	223	238	251	266
	65	167	182	197	212	226	241	255	270
	70	169	184	199	214	229	244	259	274
	75	171	186	201	216	232	247	263	276
GL036	55	172	186	200	214	229	244	260	274
	60	175	190	204	218	233	248	264	278
	65	178	193	208	222	238	252	268	282
	70	182	197	212	226	241	256	271	286
	75	185	200	215	230	245	260	275	290
GH036	55	168	182	196	209	223	238	253	268
	60	171	185	199	213	228	243	259	276
	65	173	188	203	217	233	248	266	283
	70	175	191	206	221	237	253	271	288
	75	176	193	209	225	242	258	275	292
GL042, GH042	55	177	192	208	224	239	253	269	285
	60	180	195	211	227	243	258	274	290
	65	183	198	214	230	247	263	279	295
	70	186	201	217	233	251	268	284	300
	75	189	204	220	236	255	273	289	305
GL048, GH048	55	171	182	193	204	216	228	242	257
	60	176	188	200	211	224	237	251	265
	65	181	193	206	218	232	245	258	274
	70	185	197	210	223	238	252	267	282
	75	188	201	215	228	243	258	274	291
GL060, GH060	55	173	190	204	219	236	251	266	280
	60	175	192	207	223	240	256	272	287
	65	177	194	210	227	244	261	278	294
	70	179	196	213	231	248	266	284	301
	75	181	198	216	235	252	271	290	308

*Table shows recommended discharge pressures at compressor (psig)

5. Evaluate system performance and refrigerant charge by comparing recorded readings with operating pressure/temperature tag.
6. Make slight adjustment to refrigerant charge when necessary.

NOTE: If problem causing inaccurate readings is a refrigerant leak, see Unit Preparation — REFRIGERANT LEAKS.

INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS — Models 48GH/GL have direct-drive blower motors. All motors are factory connected to deliver proper heating and cooling airflows at normal external static pressures (except for some 208-v applications).

CAUTION: For cooling operation, recommended airflow is 350 to 450 cfm per 12,000 Btuh of rated cooling capacity. For heating operation, airflow must produce a temperature rise that falls within range stamped on unit rating plate.

Table 4 shows heating airflow at various temperature rises. Table 6 shows both heating and cooling airflows at various external static pressures. Refer to these tables to determine airflow for system being installed. See Tables 1 and 6 for cooling airflow.

NOTE: Be sure that all supply- and return-air grilles are open, free from obstructions and adjusted properly.

WARNING: Disconnect electrical power to unit before changing any lead connections of blower motor. (Be sure to turn off gas supply *before* disconnecting electrical power.)

NOTE: When operating the 208/230-volt, 3-phase version of size 48GH048 at 208 volts, change lead connections of the blower motor as indicated on unit wiring label to insure a proper airflow.

CAUTION: Do not change blower-motor lead connections on 460-v units from factory setting.

The heating and/or cooling airflow of 208/230-v motors can be changed by changing lead connections of blower motor. Motor leads are color-coded as follows:

black = high speed
blue = medium speed
red = low speed

NOTE: Some blower motors do not have lead for medium speed. Factory connections and available optional connections are shown in Table 6.

For all units, motor lead connected to time delay relay (heating) determines heating speed and resulting airflow; and motor lead connected to indoor fan relay (cooling) determines cooling speed and resulting airflow. See unit wiring label.

To change heating and/or cooling speed, connect appropriate color-coded lead to appropriate relay. Be sure to properly insulate any unused motor lead. See Typical Wiring — SPECIAL PROCEDURES FOR 208-V OPERATION for proper procedures to insulate an unused electrical lead.

When installing a 208- or 230-v unit that is factory connected for heating and cooling speeds that are not the same, and same speed for both heating and cooling is required for a particular application, connect appropriate color-coded lead to terminal 2 of indoor fan relay (cooling) and connect a field-supplied jumper between time delay relay (heating) and terminal 2 of indoor fan relay (cooling). Be sure to properly insulate unused motor lead(s).

Table 6 — Air Delivery (Cfm) at Indicated External Static Pressure and Voltage*

MODEL 48 SERIES	UNIT VOLTS/ PHASE (60-Hz)	BLOWER MOTOR SPEED	APPLICATION†	EXTERNAL STATIC PRESSURE (in wg)																	
				0 0		0 1		0 2		0 3		0 4		0 5		0 6		0 7		0 8	
				208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V
GL018	208-230-1	Low	Heat	735	805	700	765	660	725	615	675	565	625	520	565	—	—	—	—	—	—
			Cool‡	725	790	690	750	650	710	605	660	555	610	510	555	—	—	—	—	—	—
320		High	Heat‡	790	870	750	825	705	780	660	735	610	685	555	630	—	—	—	—	—	—
			Cool	775	850	735	810	690	765	645	720	595	670	545	620	—	—	—	—	—	—
GL024	208-230-1	Low	Heat‡	895	950	850	905	800	855	750	800	700	745	645	680	—	—	—	—	—	—
			Cool	870	920	825	875	780	825	730	775	680	720	630	660	—	—	—	—	—	—
320		High	Heat	980	1030	930	975	875	920	820	865	765	810	695	750	—	—	—	—	—	—
			Cool‡	945	995	895	945	845	895	795	840	740	790	680	735	—	—	—	—	—	—
GH024	208-230-1	Low	Heat	960	1030	925	990	890	955	855	920	815	880	780	840	—	—	—	—	—	—
			Cool‡	935	1000	900	965	870	935	835	890	800	860	765	820	—	—	—	—	—	—
320		High	Heat‡	1125	1160	1075	1115	1030	1065	980	1015	930	965	880	915	—	—	—	—	—	—
			Cool	1085	1120	1040	1075	995	1030	950	980	900	935	855	885	—	—	—	—	—	—
GL030	208-230-1	Low	Heat‡	700	850	680	820	655	795	635	765	610	735	585	705	—	—	—	—	—	—
			Cool	690	835	670	810	650	785	630	755	605	725	580	695	—	—	—	—	—	—
320/ 330		High	Heat	1325	1370	1270	1310	1210	1245	1150	1180	1090	1110	1020	1040	—	—	—	—	—	—
			Cool‡	1270	1310	1220	1250	1160	1190	1100	1125	1040	1055	970	985	—	—	—	—	—	—
GH030	208-230-1	Low	Heat‡	1125	1175	1070	1115	1015	1050	955	985	900	925	840	855	—	—	—	—	—	—
			Cool‡	1095	1140	1035	1080	990	1025	940	965	885	905	825	840	—	—	—	—	—	—
320/ 330		High	Heat	1225	1260	1165	1200	1105	1140	1040	1080	980	1020	915	955	—	—	—	—	—	—
			Cool	1190	1220	1135	1165	1075	1110	1015	1050	955	995	895	935	—	—	—	—	—	—
GL036	208-230-1	Low	Heat‡	950	1250	945	1205	940	1160	930	1110	915	1065	900	1015	—	—	—	—	—	—
			Cool	945	1225	940	1180	935	1135	925	1090	910	1045	895	1000	—	—	—	—	—	—
320/ 330		High	Heat	1570	1610	1500	1540	1425	1470	1355	1400	1280	1330	1200	1255	—	—	—	—	—	—
			Cool‡	1505	1540	1440	1480	1375	1420	1310	1350	1235	1285	1160	1215	—	—	—	—	—	—
	208/ 230-3	Low	Heat‡	1165	1365	1150	1345	1140	1320	1125	1295	1100	1265	1075	1225	1040	1180	995	1120	930	1020
520/ 530			Cool	1160	1350	1145	1330	1130	1305	1115	1275	1090	1245	1060	1205	1025	1155	980	1085	910	955
		High	Heat	1525	1620	1490	1580	1450	1540	1415	1495	1375	1450	1330	1405	1280	1355	1220	1300	1135	1230
			Cool‡	1495	1580	1460	1540	1420	1500	1385	1460	1345	1415	1300	1370	1245	1315	1180	1255	1085	1175
	460-3	Low	Heat‡	—	1165	—	1150	—	1140	—	1125	—	1100	—	1075	—	1040	—	995	—	1120
620/ 630			Cool	—	1160	—	1145	—	1130	—	1115	—	1090	—	1060	—	1025	—	980	—	1085
		High	Heat	—	1525	—	1490	—	1450	—	1415	—	1375	—	1330	—	1280	—	1220	—	1300
			Cool‡	—	1495	—	1460	—	1420	—	1385	—	1345	—	1300	—	1245	—	1180	—	1225
GH036	208-230-1	Low	Heat	1280	1510	1260	1480	1240	1445	1215	1400	1190	1340	1160	1275	—	—	—	—	—	—
			Cool‡	1270	1485	1250	1450	1225	1410	1200	1360	1175	1300	1145	1235	—	—	—	—	—	—
320/ 330		High	Heat‡	1825	1905	1765	1845	1700	1775	1630	1700	1540	1590	1440	1450	—	—	—	—	—	—
			Cool	1760	1825	1695	1770	1625	1695	1550	1600	1465	1485	1350	1360	—	—	—	—	—	—
	208/ 230-3	Low	Heat	1275	1505	1270	1490	1260	1470	1240	1445	1220	1415	1195	1375	1165	1330	1135	1280	1100	1230
			Cool‡	1270	1490	1260	1470	1250	1450	1230	1420	1205	1385	1180	1345	1150	1300	1120	1250	1085	1195
		Med	Heat	1625	1845	1605	1805	1575	1760	1540	1710	1500	1655	1455	1595	1400	1540	1350	1480	1295	1415
520/ 530			Cool	1605	1800	1575	1755	1545	1705	1505	1655	1460	1600	1415	1540	1360	1485	1310	1425	1255	1360
		High	Heat‡	2035	2130	1980	2070	1920	2010	1855	1940	1785	1870	1715	1800	1645	1725	1570	1645	1495	1570
			Cool	1960	2045	1905	1985	1840	1925	1775	1860	1710	1790	1645	1720	1575	1650	1505	1575	1435	1500
GL042	208-230-1	Low	Heat‡	855	1035	845	1025	835	1010	820	995	795	975	760	950	—	—	—	—	—	—
			Cool	850	1030	840	1020	830	1005	815	990	790	965	755	940	—	—	—	—	—	—
320		High	Heat	1700	1770	1635	1705	1565	1635	1495	1555	1425	1470	1355	1385	—	—	—	—	—	—
			Cool‡	1635	1705	1570	1635	1505	1560	1440	1485	1375	1405	1305	1330	—	—	—	—	—	—
	208/ 230-3	Low	Heat‡	970	1190	965	1180	960	1175	950	1160	935	1145	910	1120	880	1080	835	1020	780	940
520			Cool	965	1185	960	1175	955	1165	945	1150	930	1135	905	1105	870	1060	825	995	770	915
		High	Heat	2040	2145	1980	2080	1915	2010	1850	1940	1785	1865	1715	1790	1640	1705	1550	1610	1450	1500
			Cool‡	1960	2050	1900	1985	1840	1920	1775	1850	1710	1780	1640	1700	1560	1615	1470	1515	1385	1410
GH042	208-230-1	Low	Heat‡	1410	1580	1385	1530	1355	1475	1315	1420	1255	1360	1175	1290	—	—	—	—	—	—
			Cool	1390	1535	1365	1485	1330	1435	1280	1380	1215	1315	1120	1240	—	—	—	—	—	—
320		High	Heat	1705	1770	1650	1710	1590	1645	1525	1575	1450	1500	1365	1415	—	—	—	—	—	—
			Cool‡	1650	1705	1590	1645	1530	1580	1465	1515	1390	1435	1290	1340	—	—	—	—	—	—
	208/ 230-3	Low	Heat‡	1405	1650	1400	1635	1395	1610	1385	1580	1365	1545	1335	1500	1295	1445	1240	1380	1175	1305
520			Cool	1400	1640	1395	1620	1385	1590	1370	1555	1345	1510	1310	1460	1260	1400	1210	1335	1145	1270
		High	Heat	1725	1935	1710	1885	1685	1835	1655	1780	1615	1730	1565	1670	1505	1610	1440	1540	1370	1455
			Cool‡	1705	1875	1685	1825	1655	1775	1615	1725	1570	1670	1515	1615	1455	1550	1390	1475	1320	1360

Table 6 — Air Delivery (Cfm) at Indicated External Static Pressure and Voltage* (Cont)

MODEL 48 SERIES	UNIT VOLTS/ PHASE (60-Hz)	BLOWER MOTOR SPEED	APPLICATION†	EXTERNAL STATIC PRESSURE (in wg)																	
				0 0		0 1		0 2		0 3		0 4		0 5		0 6		0 7		0 8	
				208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V	208 V	230 V or 460 V
GL048		Low	Heat‡	—	1350	—	1340	—	1330	—	1310	—	1275	—	1190	—	—	—	—	—	—
320	230-1		Cool	—	1345	—	1335	—	1320	—	1300	—	1250	—	1150	—	—	—	—	—	—
		High	Heat	—	1920	—	1845	—	1770	—	1695	—	1620	—	1550	—	—	—	—	—	—
			Cool‡	—	1860	—	1790	—	1720	—	1645	—	1575	—	1505	—	—	—	—	—	—
520	208/ 230-3	Low	Heat‡	1150	1395	1150	1395	1150	1395	1150	1390	1150	1385	1150	1370	1145	1355	1135	1330	1115	1300
			Cool	1150	1395	1150	1395	1150	1390	1150	1385	1150	1380	1145	1365	1140	1345	1130	1320	1110	1285
		Med	Heat	1805	2080	1800	2050	1785	2015	1760	1970	1735	1920	1700	1865	1665	1805	1625	1745	1585	1680
			Cool	1800	2050	1790	2015	1770	1970	1740	1925	1710	1870	1675	1815	1635	1755	1595	1700	1560	1640
		High	Heat	2200	2325	2155	2275	2105	2220	2055	2160	2000	2095	1940	2030	1880	1965	1815	1895	1755	1825
			Cool‡	2150	2260	2105	2205	2055	2150	2000	2090	1940	2030	1880	1965	1825	1900	1765	1835	1705	1770
620	460-3	Low	Heat‡	—	1500	—	1480	—	1460	—	1435	—	1410	—	1380	—	1350	—	1325	—	1290
			Cool	—	1490	—	1465	—	1445	—	1420	—	1395	—	1365	—	1340	—	1310	—	1280
		High	Heat	—	2040	—	1995	—	1950	—	1895	—	1835	—	1775	—	1710	—	1645	—	1555
			Cool‡	—	1995	—	1950	—	1900	—	1845	—	1790	—	1725	—	1665	—	1600	—	1535
GH048		Low	Heat‡	—	1790	—	1730	—	1665	—	1600	—	1530	—	1450	—	—	—	—	—	—
320	230-1		Cool	—	1745	—	1685	—	1625	—	1555	—	1485	—	1400	—	—	—	—	—	—
		High	Heat	—	1975	—	1900	—	1820	—	1745	—	1665	—	1590	—	—	—	—	—	—
			Cool‡	—	1905	—	1835	—	1760	—	1690	—	1615	—	1545	—	—	—	—	—	—
520	208/ 230-3	Low	Heat**	1440	1730	1435	1720	1425	1700	1415	1675	1400	1645	1385	1610	1365	1565	1340	1520	1305	1470
			Cool	1435	1720	1430	1705	1420	1685	1410	1655	1395	1620	1375	1585	1355	1540	1325	1490	1285	1440
		Med	Heat**	1755	1970	1740	1945	1725	1910	1700	1870	1665	1825	1625	1775	1580	1720	1525	1660	1470	1600
			Cool‡	1745	1945	1730	1915	1705	1875	1675	1835	1640	1785	1595	1730	1550	1675	1495	1620	1435	1560
		High	Heat	1950	2175	1920	2130	1880	2085	1840	2030	1795	1970	1750	1905	1700	1840	1645	1765	1590	1695
			Cool	1920	2125	1885	2080	1845	2030	1805	1970	1760	1910	1710	1850	1660	1780	1610	1715	1555	1645
GL060		Low	Heat‡	—	1585	—	1585	—	1580	—	1560	—	1530	—	1495	—	—	—	—	—	—
320/ 330	230-1		Cool	—	1585	—	1585	—	1575	—	1550	—	1515	—	1475	—	—	—	—	—	—
		High	Heat	—	2375	—	2280	—	2185	—	2095	—	2000	—	1905	—	—	—	—	—	—
			Cool‡	—	2235	—	2150	—	2075	—	1985	—	1905	—	1820	—	—	—	—	—	—
GH060		Low	Heat	—	1880	—	1875	—	1860	—	1825	—	1770	—	1700	—	—	—	—	—	—
320/ 330	230-1		Cool	—	1875	—	1855	—	1820	—	1765	—	1700	—	1625	—	—	—	—	—	—
		Med	Heat‡	—	2130	—	2075	—	2015	—	1955	—	1890	—	1810	—	—	—	—	—	—
			Cool	—	2050	—	1995	—	1940	—	1875	—	1800	—	1705	—	—	—	—	—	—
		High	Heat	—	2345	—	2260	—	2180	—	2095	—	2010	—	1930	—	—	—	—	—	—
			Cool‡	—	2210	—	2135	—	2060	—	1985	—	1910	—	1835	—	—	—	—	—	—

*Air delivery values for all sizes of Models 48GH/GL are without air filter

†Heating airflow values are with a dry coil. Cooling airflow values are with a wet coil

‡These airflow values are at the factory heating and cooling blower motor speed setting

**The heating blower motor speed for these units is factory wired for low speed at 230-v operation For 208-v operation, the heating speed should be changed to medium See unit wiring label

A dash (—) indicates portions of the table that are beyond the blower motor capability or that are not applicable

NOTE: Do not operate the unit at a cooling airflow that is less than 350 cfm per each 12,000 Btuh of rated cooling capacity Indoor coil icing may occur at airflows below this point

CONTROLS — All compressors have the following internal-protection controls:

High-Pressure Relief Valve — This valve opens when pressure differential between low and high side becomes excessive.

Compressor Overload — This overload interrupts power to compressor when either current or internal temperature become excessive, and automatically resets when internal temperature drops to a safe level. This overload may require up to 60 minutes (or longer) to reset; therefore, if internal overload is suspected of being open, disconnect electrical power to unit and check circuit thru the overload with an ohmmeter or continuity tester.

Time Guard II — This solid-state electronic device assures a 5-minute delay between stop and restart of unit compressor. This allows for internal pressure to equalize and permits easy, unloaded start-up with minimum stress on compressor.

OPERATING SEQUENCE

Heating — The following sequence of operation pertains to all 208/230-volt, 3-phase units; however, the sequence of operation of single-phase and 460-volt units is very similar. Refer to line-to-line wiring diagram in Fig. 9.

NOTE: Although actual unit wiring may vary slightly from that shown in Fig. 9, sequence of operation will not be affected.

With room thermostat selector switch at HEAT position and the fan switch at AUTO. position, heating sequence of operation is as follows:

Models 48GH/GL have an intermittent RELITE-type pilot without a standing flame. When manual control valve is opened, gas flows to solenoid valve chamber of gas valve. Unit is now in a standby condition and ready for a call for heat from room thermostat.

When room temperature drops to a point that is slightly below heating control setting of room thermostat, thermostat heating bulb tilts and completes circuit between thermostat terminals R and W. This completed circuit between R and W thru room thermostat simultaneously energizes pilot gas valve (part of gas valve) and pilot igniter. The energized pilot gas valve permits gas to flow to pilot.

NOTE: Pilot gas valve is a solenoid consisting of a PICK and a HOLD coil. Both coils must be energized to open pilot gas valve, but only HOLD coil must be energized to keep valve open.

Energized pilot igniter sends a high-voltage charge to pilot electrode (part of pilot). Pilot electrode produces a spark that ignites pilot. Flame-sensing monometal switch in pilot proves presence of pilot flame. Approximately 40 to 60 seconds after pilot flame is established, normally closed contacts of pilot open and normally open contacts close. Switching of pilot contacts de-energizes pilot igniter and PICK coil of pilot solenoid. HOLD coil of pilot solenoid is still energized; therefore, pilot gas valve remains open and pilot remains lit.

WARNING: If pilot fails to light, do not attempt to manually light intermittent-type pilot with a match or other source of flame.

The switching of pilot contacts also completes low-voltage circuit to time delay relay (heating), and terminal 1 of gas valve. After approximately 10 seconds, heat-motor-operated gas valve opens and permits gas to flow to burners where gas is ignited by pilot. Ignited burners heat the heat exchanger.

After built-in time delay, normally open relay contacts of energized time delay relay (heating) close, and circuit to indoor fan motor is completed. Fan motor starts.

The heating cycle remains on until room temperature rises to a point that is slightly above heating control setting of room thermostat. At this point, thermostat heating bulb tilts and breaks circuit between thermostat terminals R and W. The gas flow thru gas valve stops and burner flames go out. Gas flow thru pilot gas valve also stops and pilot flame goes out.

Time delay relay (heating) de-energizes; however, there is a built-in delay before heat relay contacts open, and blower continues to move air across heat exchanger to help optimize heating efficiency. When heat relay contacts open, circuit to indoor fan motor breaks and motor stops.

Unit is in a standby condition, waiting for next call for heat from thermostat.

Cooling — The following sequence of operation pertains to all 208/230-volt, 3-phase units; however, sequence of operation of single-phase and 460-volt units is very similar. Refer to line-to-line wiring diagram in Fig. 9.

NOTE: Although actual unit wiring may vary slightly from that shown in Fig. 9, sequence of operation will not be affected.

With room thermostat selector switch in the COOL position and fan switch in AUTO. position, cooling sequence of operation is as follows:

When room temperature rises to a point that is slightly above cooling control setting of thermostat, thermostat cooling bulb tilts and completes circuit between thermostat terminal R to terminals Y and G. These completed circuits thru the thermostat connect Time Guard II circuit (thru unit wire Y) and indoor fan relay (cooling) (thru unit wire G) across the 24-volt secondary of transformer. After a 3-second delay, Time Guard II circuit energizes contactor.

The 2 sets of normally open contacts of energized contactor close and complete the circuit thru compressor and outdoor fan motor. Both motors start instantly.

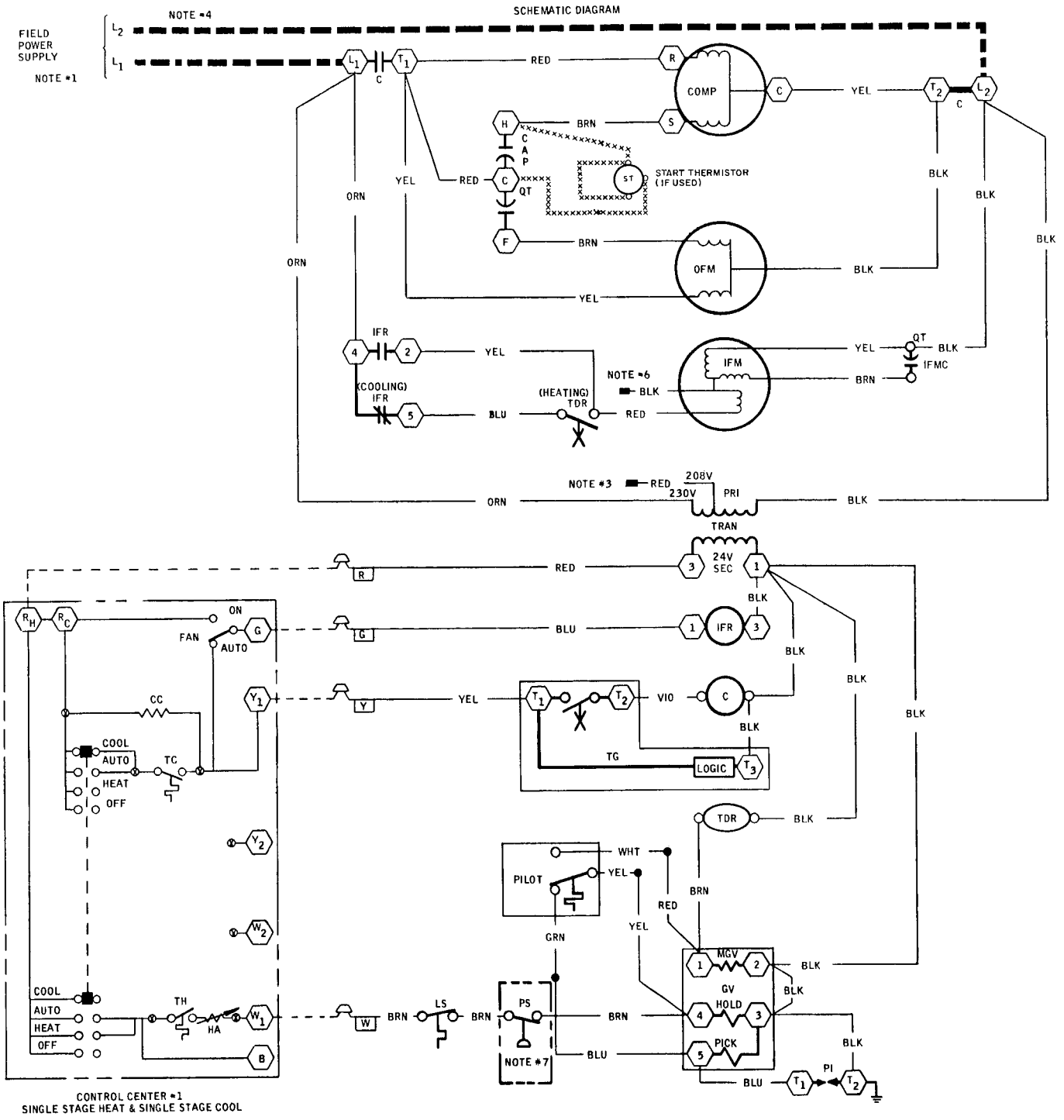


Fig. 9 — Typical Wiring Diagram

The set of normally open contacts of energized indoor fan relay (cooling) closes and completes circuit thru indoor fan motor. The blower motor starts instantly.

The cooling cycle remains on until room temperature drops to a point that is slightly below cooling control setting of room thermostat. At this point, thermostat cooling bulb tilts and breaks circuit between thermostat terminal R to terminal Y and G. These open circuits de-energize contactor and indoor fan relay (cooling) and Time Guard II circuit. The condenser, compressor and blower motors stop. The unit is in a standby condition, waiting for next call for cooling from room thermostat. Time Guard II circuit prevents short-cycling of compressor by a 5-minute time delay between stop and restart.

SERVICE

To ensure continuing high performance, and to minimize the possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This combination heating/cooling unit should be inspected at least once each year by a qualified service person.

Note to Equipment Owner: Consult your local dealer about the availability of a maintenance contract.

WARNING: The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the Owner's Manual. A FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY AND EQUIPMENT DAMAGE.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean when necessary.
3. Inspect blower motor and wheel for cleanliness and check lubrication each heating and cooling season. Clean and lubricate when necessary
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service when necessary.
5. Check and inspect heating section before each heating season. Clean and adjust when necessary.

WARNING: A failure to follow these warnings could result in serious personal injury:

1. Turn off gas supply, *then disconnect electrical power to the unit before performing any maintenance or service.*
2. Use extreme caution when removing panels and parts. As with any mechanical equipment, personal injury can result from sharp edges, etc.
3. Never place anything combustible either on, or in contact with, the unit.

Top Removal

WARNING: When removing unit top, use extreme caution to protect seal that isolates heat exchanger and flue products from other sections. Removal of top must never be attempted by anyone other than qualified technicians.

CAUTION: Condenser fan and motor are fastened to unit top. When removing top, use extreme care to not pull fan motor leads loose.

NOTE: When performing maintenance or service procedures that require removal of unit top, be sure to perform *all* routine maintenance procedures that require top removal, including: inspection of heat exchanger area, coil inspection and cleaning, and condensate drain pan inspection and cleaning.

When performing maintenance and service procedures that require unit top removal, refer to the following top removal procedures:

1. Turn off gas supply, *then* disconnect electric power to unit.
2. Remove vent cap and combustion-air assemblies. Do not damage gasket. (Refer to Venting section and reverse assembly procedures shown.)
3. Remove all screws that secure unit top, including screws around 4 sides and those on top that screw into internal divider panels. Save all screws.
4. Tape all side panels at each seam near unit top. Use tape strips that are at least 5 in. long to prevent sides from falling when top is removed.
5. Carefully lift top from unit. Set top on edge and ensure that it is supported by unit side that is opposite duct (or plenum) side. *Use extreme care to prevent damage to the seal that isolates heat exchanger and flue products or the fan blades, motor, and insulation.*
6. Carefully replace and secure top to unit using screws removed in step 3 when maintenance and/or service procedures are concluded. (Be sure to use original screws that have rubber washers to seal out water when securing top to internal divider panels.)
7. Reinstall vent cap and combustion-air assemblies. (Refer to Venting section.)

Air Filter

CAUTION: Never operate unit without a suitable air filter in return-air duct system. Always replace filter with same size and type. See Table 1 for recommended filter sizes.

Inspect air filter(s) at least once each month and replace (disposable-type) or clean (cleanable-type) at least twice during each heating and cooling season or whenever the filter(s) becomes clogged with dust or lint.

Models 48GH/GL do not have factory-supplied air filters. Field-supplied air filter(s) may be either disposable or cleanable. Remove access door on return-air inlet side of plenum to gain access to filters. See Fig. 1. Replace these filters with same size and type when necessary.

Evaporator Blower Wheel and Motor — For longer life, operating economy and continuing efficiency, clean accumulated dirt and grease from blower wheel and motor annually.

Lubricate motor every 5 years if motor is used intermittently (thermostat fan switch in AUTO. position), or every 2 years if motor is used continuously (thermostat fan switch in ON position).

WARNING: Turn off gas supply, *then* disconnect electrical power to unit before cleaning and lubricating blower motor and wheel.

Clean and lubricate blower motor and wheel as follows:

1. Remove and disassemble blower assembly as follows:
   a. Remove blower and control access panels.
   b. Refer to unit wiring label and disconnect blower motor leads from their termination points in unit control box. (Be sure to mark wiring label appropriately if lead terminations were not previously marked.) Pull leads into blower compartment.
   c. Remove blower assembly from unit. Be careful not to tear insulation in blower compartment.
   d. Ensure proper reassembly by marking blower wheel and motor in relation to blower housing before disassembly.
   e. Loosen setscrew(s) that secures wheel to motor shaft, remove screws that secure motor mount brackets to housing and slide motor and motor mount out of housing.
2. Lubricate motor as follows:
   a. Thoroughly clean all accumulations of dirt or grease from motor housing.
   b. Remove dust caps or plugs from oil ports located at each end of motor.
   c. Use a good grade of SAE 20 nondetergent motor oil and put one teaspoon, 5 cc, 3/16 oz, or 16 to 25 drops in each oil port.
   d. Allow time for oil to be absorbed by each bearing, then wipe excess oil from motor housing
   e. Replace dust caps or plugs in oil ports.
3. Remove and clean blower wheel as follows:
   a. Ensure proper reassembly by marking wheel orientation and cutoff plate location.
   b. Remove screws holding cutoff plate, and remove plate from housing.
   c. Lift wheel from housing. When handling and/or cleaning blower wheel, be sure not to disturb balance weights (clips) on blower wheel vanes, and be sure not to drop or bend wheel.
   d. Remove caked-on dirt from wheel and housing with a brush. Remove lint and/or dirt accumulation from wheel and housing with vacuum cleaner, using soft brush attachment. Remove grease and oil with mild solvent.
   e. Reassemble wheel and cutoff plate into housing.
4. Reassemble motor into housing. Be sure setscrew(s) is tightened on motor shaft flats and not on round part of shaft.
5. Reinstall blower assembly into unit, route blower leads into control compartment and reconnect all blower motor leads to proper termination points in unit control box. Replace panels.
6. Restore electrical power, *then* gas supply to unit. Start unit and check for proper blower rotation and motor speeds during heating and cooling cycles.

Heating Section — Ensure dependable and efficient heating operating by inspecting heating section before each heating season and cleaning when necessary.

Proceed as follows to inspect and clean heating section:

1. Turn off gas supply, *then* disconnect electrical power to unit.
2. Inspect and clean heating section as follows:
   a. Remove control access door.
   b. Remove unit top following procedures under Top Removal.
   c. Remove secondary-air shield, flue baffles, pilot, and burners. (Flue baffles may be removed after partial loosening of collector front panel.) Inspect and clean all of these components.
   d. Clean flue ways with brush and/or vacuum, and inspect heat exchanger for leaks and cracks.
   e. Inspect indoor-air passages in unit for cleanliness, and check tightness of screws and parts.
   f. Replace all components removed in step c, and replace unit top.
3. Restore electrical power, *then* gas supply to unit. Start heating cycle and adjust burner air shutters. See Heating Section Start-Up and Adjustments — ADJUSTING BURNER AIR SHUTTERS.

WARNING: Never use a match or other flame to check for gas leaks.

4. Inspect gas control area for gas leaks, using a soap-and-water solution.
5. Replace control access panel.

Pilot — See Fig. 10. Inspect pilot and clean (when necessary) at beginning of each heating season. Remove accumulation of soot and carbon from only the outside of pilot. The pilot flame must be high enough to touch the flame-sensing element and to light burners.

Condenser Coil, Evaporator Coil, and Condensate Drain Pan — Inspect condenser coil, evaporator coil, and condensate drain pan at least once each year. Proper inspection and cleaning requires the removal of unit top. See Top Removal.

The coils are easily cleaned when dry; therefore, inspect and clean coils either before or after each cooling season. Remove all obstructions including weeds and shrubs that interfere with airflow thru condenser coil. Straighten bent fins with a fin comb. If coated with dirt or lint, clean the coils with a vacuum cleaner, using soft brush attachment. Be careful not to bend fins. If coated with oil or grease, clean the coils with a mild detergent-and-water solution. Rinse coils with clear water, using a garden hose. Be careful not to splash water on motors, insulation, wiring, or air filter(s). For best results, spray condenser coil fins from inside to outside the unit. On units with an outer and inner condenser coil, be sure to clean between coils. Be sure to flush all dirt and debris from unit base.

Inspect drain pan and condensate drain line when inspecting the coils. Clean drain pan and condensate drain by removing all foreign matter from pan. Flush pan and drain tube with clear water. Do not splash water on insulation, motor, wiring, or air filter(s). If drain tube is restricted, clear it with a "plumbers snake" or similar probe device.

The bottom of drain tube has a 1/8-in. diameter hole. This hole is located in portion of the drain tube that runs thru drain pan. Clean this hole with a stiff wire that has a 3/8-in. long, 90 degree bend.

Condenser Fan

CAUTION: Keep condenser fan free of all obstructions to ensure proper cooling operation. Never place articles on top of unit.

Inspect fan blades for cracks or bends each year. *Ensure that blades clear the motor by exactly 1/4 inch.* If blade assembly has slipped down motor shaft, adjust fan position on motor shaft by loosening setscrew(s), then moving blade assembly up. Be sure that setscrews(s) is on flat(s) of shaft before tightening.

Electrical Controls and Wiring — Inspect and check electrical controls and wiring annually. *Be sure to turn off gas supply and then electrical power to unit.*

Remove control, blower, and compressor compartment access panels to locate all electrical controls and wiring. Check all electrical connections for tightness. Tighten all screw connections. If any smoky or burned connections are noticed: disassemble the connection, clean all parts, restrip wire end, and reassemble connection properly and securely.

After inspecting electrical controls and wiring, replace all panels. Start unit, and observe at least one complete heating cycle and one complete cooling cycle to ensure proper operation. If discrepancies are observed in either or both operating cycles, or if a suspected malfunction has occurred, check each electrical component with proper electrical instrumentation. Refer to unit wiring label when making these checkouts.

NOTE: Refer to heating and/or cooling sequence of operation in this publication as an aid in determining proper control operation.

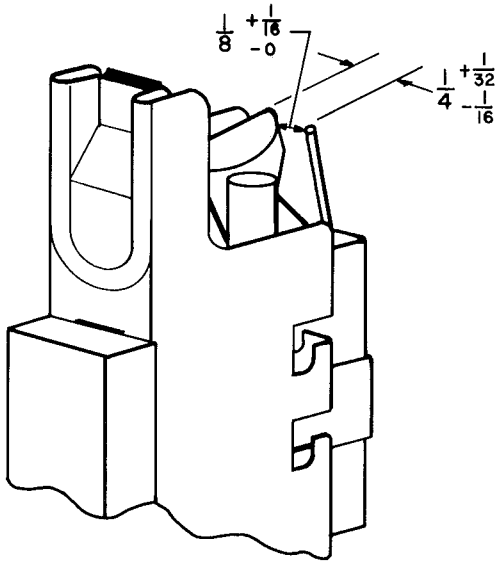


Fig. 10 — Position of Electrode to Pilot

Refrigerant Circuit — Inspect all refrigerant tubing connections and unit base for oil accumulations annually. Presence of oil generally indicates a refrigerant leak.

If oil is detected or if low cooling performance is suspected, leak-test all refrigerant tubing using an electronic leak-detector, halide torch, or liquid-soap solution. If a refrigerant leak is detected, see Unit Preparation — Refrigerant Leaks.

If no refrigerant leaks are found and low cooling performance is suspected, see Cooling Section Start-Up and Adjustments — Checking And Adjusting Refrigerant Charge.

Gas Input — Gas input does not require checking unless improper heating performance is suspected. If a problem exists, refer to Heating Section Start-Up and Adjustments.

Evaporator Airflow — Heating and/or cooling airflow does not require checking unless improper performance is suspected. *If a problem exists, be sure that all supply- and return-air grilles are open and free from obstructions, and that the air filter is clean.* When necessary, refer to Cooling Section Start-Up and Adjustments INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS to check system airflow.

TROUBLESHOOTING CHARTS

Table 7 — Heating Service Analysis Chart

SYMPTOM	CAUSE	REMEDY
Pilot Will Not Light	No spark at electrode	Check air gap between electrode tip and pilot burner Gap should be as shown in Fig. 10 Readjust as necessary.
		Clean moisture or dirt accumulation on electrode ceramic with cloth.
		Cracked ceramic — replace pilot electrode assembly.
		Check for loose or broken wiring at and between spark generator and electrode. Replace wire or tighten connection as necessary.
		Check fuses or circuit breaker to ensure voltage to unit.
		Check 24-volt input to spark generator If you read 24 volts and above steps have been completed, replace spark generator.
	Spark shorting out to main burner	Realign electrode tip away from main burner but maintain spark gap to pilot burner. See Fig. 10.
	No gas at pilot burner	Clean pilot orifice.
		Check for voltage to terminals 3 and 5 of gas valve.
		Check to see if pilot valve is opening Check for loose or broken wiring connections If no deficiency is found, replace gas valve
Burners Will Not Ignite	Water in gas line	Drain — install water trap.
	No power to furnace	Check power supply, fuses, wiring, or circuit breaker.
	No 24-volt power supply to control circuit	Check transformer — replace if necessary
	Miswired or loose connections	Check all wiring and wirenut connections.
	Dirty pilot — yellow flame	Clean pilot orifice.
	Pilot burning properly — sharp blue flame	Replace pilot
	Burned out heat anticipator in thermostat	Replace thermostat
	No gas at main burners	Check to see if main gas valve is opening. Look for loose or broken wiring connections If no deficiency is found, replace valve assembly.
	Broken thermostat wire	Run continuity check to locate break.
Inadequate Heating	Dirty air filter	Replace filter.
	Gas input to furnace too low	Check gas pressure at manifold Clock gas meter for input. If too low, increase manifold pressure or replace with correct orifices.
	Unit undersized for application	Replace with proper unit — or add additional unit.
	Restricted airflow	Clean or replace filter — or remove any restriction.
	Blower speed too low	Use faster speed tap — or install optional blower.
	Limit switch cycles main burners	Dirty air filters — clean or replace.
		Registers closed, restricted ductwork — open or remove restriction.
		Check heat anticipator setting on thermostat — readjust.
Poor Flame Characteristics	Incomplete combustion results in Aldehyde odors, (CO), sooting flame — floating flame	Air shutters on burners closed — adjust to soft blue flame.
		Check all screws around flue outlets and burner compartment — tighten.
		Lack of combustion air.
		Cracked heat exchanger — replace.
		Overfired furnace — reduce input or change orifices.
		Check vent for restriction — clean as required.
		Check orifice to burner alignment.

Table 8 — Cooling Service Analysis Chart

SYMPTOM	CAUSE	REMEDY
Compressor and Condenser Fan Will Not Start	Power failure	Call power company.
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker
	Defective thermostat, contactor, transformer, or control relay	Replace component
	Insufficient line voltage	Determine cause and correct
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly
	Thermostat setting too high	Lower thermostat setting below room temperature.
Compressor Will Not Start But Condenser Fan Runs	Faulty wiring or loose connections in compressor circuit	Check wiring and repair or replace
	Compressor motor burned out, seized, or internal overload open	Determine cause Replace compressor
	Defective run/start capacitor, overload, start relay	Determine cause and replace
	One leg of three-phase power dead	Replace fuse or reset circuit breaker Determine cause.
Compressor Cycles (other than normally satisfying thermostat)	Refrigerant overcharge or undercharge	Blow refrigerant, evacuate system, and recharge to nameplate
	Defective compressor	Replace and determine cause
	Insufficient line voltage	Determine cause and correct
	Blocked condenser	Determine cause and correct.
	Defective run/start capacitor, overload, or start relay	Determine cause and replace
	Defective thermostat	Replace thermostat
	Faulty condenser fan motor or capacitor	Replace
	Restriction in refrigerant system	Locate restriction and remove
Compressor Operates Continuously	Dirty air filter	Replace filter
	Unit undersized for load	Decrease load or increase unit size
	Thermostat set too low	Reset thermostat
	Low refrigerant charge	Locate leak, repair, and recharge
	Leaking valves in compressor	Replace compressor
	Air in system	Blow refrigerant, evacuate system, and recharge
	Condenser coil dirty or restricted	Clean coil or remove restriction
Excessive Head Pressure	Dirty air filter	Replace filter
	Dirty condenser coil	Clean coil
	Refrigerant overcharged	Purge excess refrigerant
	Air in system	Blow refrigerant, evacuate system, and recharge
	Condenser air restricted or air short-cycling	Determine cause and correct
Head Pressure Too Low	Low refrigerant charge	Check for leaks, repair, and recharge
	Compressor valves leaking	Replace compressor
	Restriction in liquid tube	Remove restriction
Excessive Suction Pressure	High heat load	Check for source and eliminate
	Compressor valves leaking	Replace compressor
	Refrigerant overcharged	Purge excess refrigerant
Suction Pressure Too Low	Dirty air filter	Replace filter
	Low refrigerant charge	Check for leaks, repair, and recharge
	Metering device or low-side restricted	Remove source of restriction
	Insufficient evaporator airflow	Increase air quantity Check filter — replace if necessary
	Temperature too low in conditioned area	Reset thermostat
	Outdoor ambient temperature below 55 F	Install accessory low-ambient kit
	Field-installed filter drier restricted	Replace